F98
SQUIDs and Noise Thermometers

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Structure

- Goals of the experiment
- Theoretical Background
  - SQUIDs
  - Noise Thermometers
- Measuring principles
  - dc-SQUID Characteristics
  - Flux-Locked-Loop (FLL)
  - Two-Stage SQUID-Readout
  - Temperature measurement
- Experimental Setup & Tasks
- Evaluation of measurements
- Discussion of end results
- Comments

Goals of experiment

- Learn basics of low-temperature physics
- Learn basics of SQUIDs and noise thermometers
- Lean how to operate dc-SQUIDs

Theoretical background

- SQUIDS

Noise Thermometers

Experiment Setup & Tasks

Experiment Setup & Tasks

Tasks and purpose:

1. Resistance at room temperature and in liquid Helium:
   Observe the change in Resistence

2. Current - Voltage characteristics $V - I$:
   Estimate critical current I_C

3. Measure the $V - \Phi$ Characteristics:
   Determine the inverse mutual inductance M_{IN}^{-1} and $M_{\Phi B}^{-1}$

4. Measure output resulting from periodic input signal:
   Determine the amplification

5. Measure Noise at different GBP:
   Finding an optimal value for the GBP

6. Measure Noise Spectrum with a two stage SQUID:
   Calculate the temperature

- Superconductivity

  Superconductivity:
  Expulsion of magnetic fields from a
  superconductor below its critical
  temperature.

- Superconductivity
  - Meissner-Ochsenfeld effect

  Meissner-Ochsenfeld Effect:
  Expulsion of magnetic fields from a superconductor below its critical temperature.

- Josephson junction

Josephson junction:
Josephson junction

- Josephson junction
  - Flux quantization

Flux Quantization :
Flux quantization plays a role in the phase relationship between the two superconductors.

- Josephson junction

  - Cooper pairs

Cooper Pairs:
Cooper pairs tunnel through the insulating barrier, causing the Josephson effect.

SQUIDs:
SQUIDs.

- SQUIDs

DC SQUID:

A superconducting quantum interference device with two Josephson junctions for measuring magnetic flux.

- SQUIDs
  - DC SQUID

Flux Locked Loop:
A feedback loop that stabilizes the SQUID output by maintaining constant magnetic flux

- SQUIDs

  - Flux locked loop

Two-Stage SQUID:
Enhances sensitivity by using a primary
SQUID amplified by a secondary stage.

- SQUIDs

  - Two-stage SQUID